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(54) **SWITCHABLE ANTENNA FOR RADIO COMMUNICATION DEVICES**

(75) Inventors: **Chye Lin Lee**, Relau; **Peng How Khoo**, Tanjong Bungah; **Giap Hong Lim**; **Boon Eu Seow**, both of Relau, all of (MY)

(73) Assignee: **Motorola, Inc.**, Schaumburg, IL (US)

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(52) **U.S. Cl.** **343/895**; 343/702; 343/876; 343/906
(58) **Field of Search** 343/702, 895, 343/876, 906; H01Q 1/36

(56) **References Cited**

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4,772,895	9/1988	Garay et al.	343/895
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Primary Examiner—Don Wong
Assistant Examiner—Hoang Nguyen
(74) *Attorney, Agent, or Firm*—Dale W. Dorinski

(57) **ABSTRACT**

A switchable antenna (**10**) with a base antenna assembly (**11**), a secondary antenna assembly (**12**) and a switch. Base and secondary antenna assemblies (**11,12**) have respective housings (**21,23**) to respectively house helical antennas (**31,40**). Secondary antenna assembly (**12**) is mounted to and operably coupled to base antenna assembly (**11**) with a connector (**13**). A contact member (**18**) of base antenna assembly (**11**) has a contact ball bearing (**20**) and a conductive plate (**22**). Secondary antenna assembly (**12**) has a contact member (**19**) with a conductive plate (**25**) and a dimple (**26**). The switch is formed by connector (**13**), ball bearing (**20**) and conductive plates (**22,25**) and selectively electrically couples adjacent ends (**32,41**) of helical antennas (**31,40**) by relative rotation about a common longitudinal axis (**43**).

8 Claims, 4 Drawing Sheets

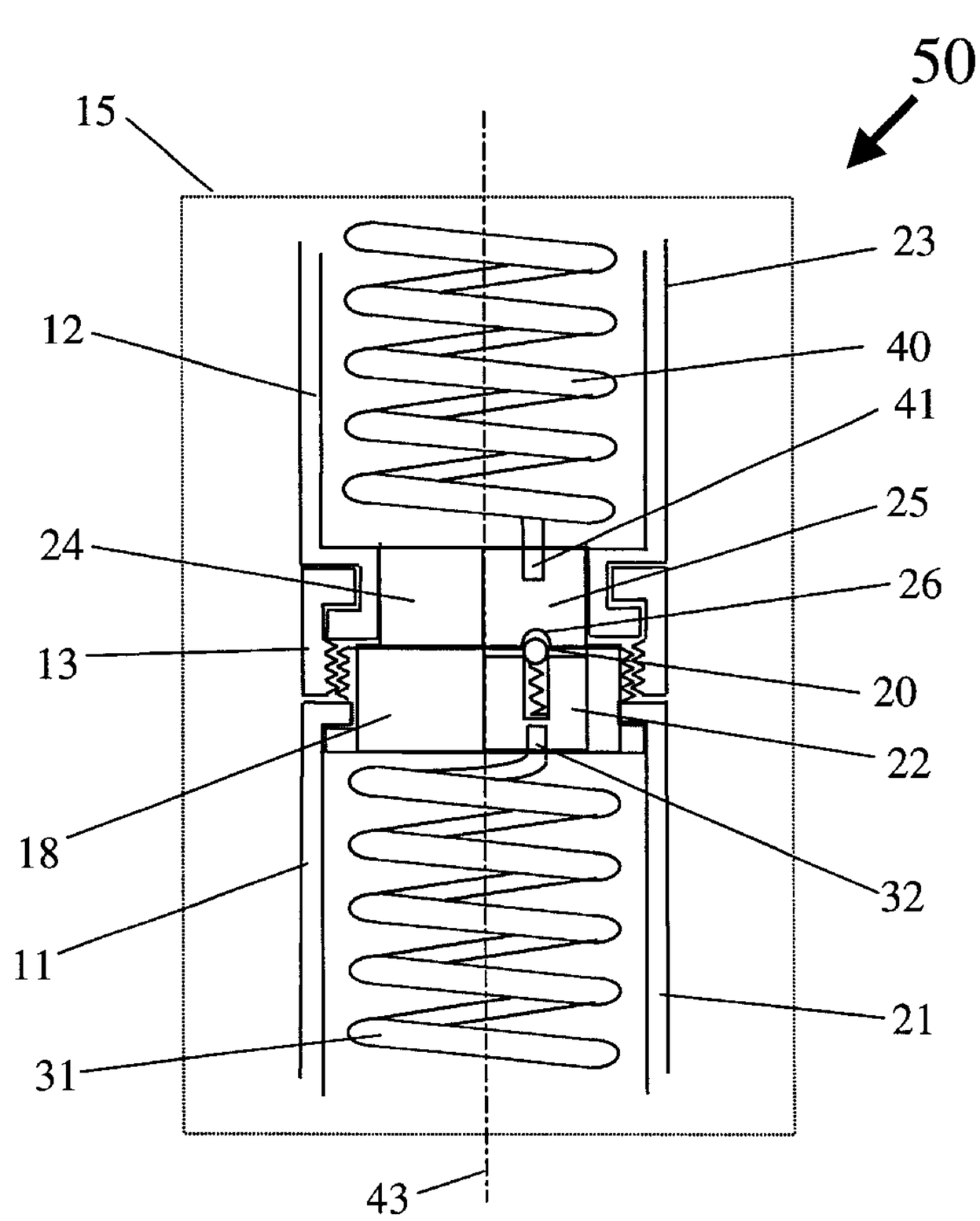


Fig. 1

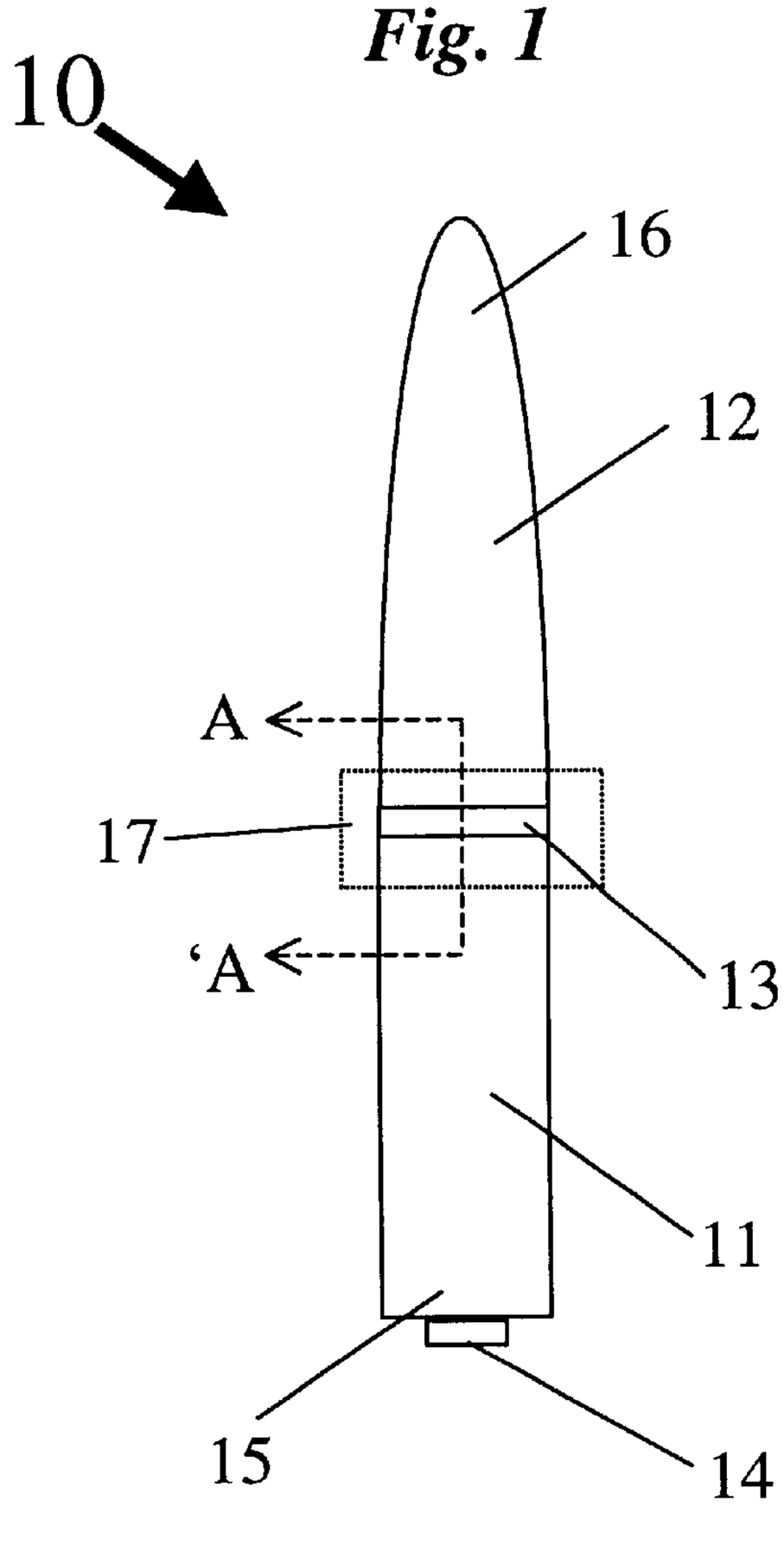
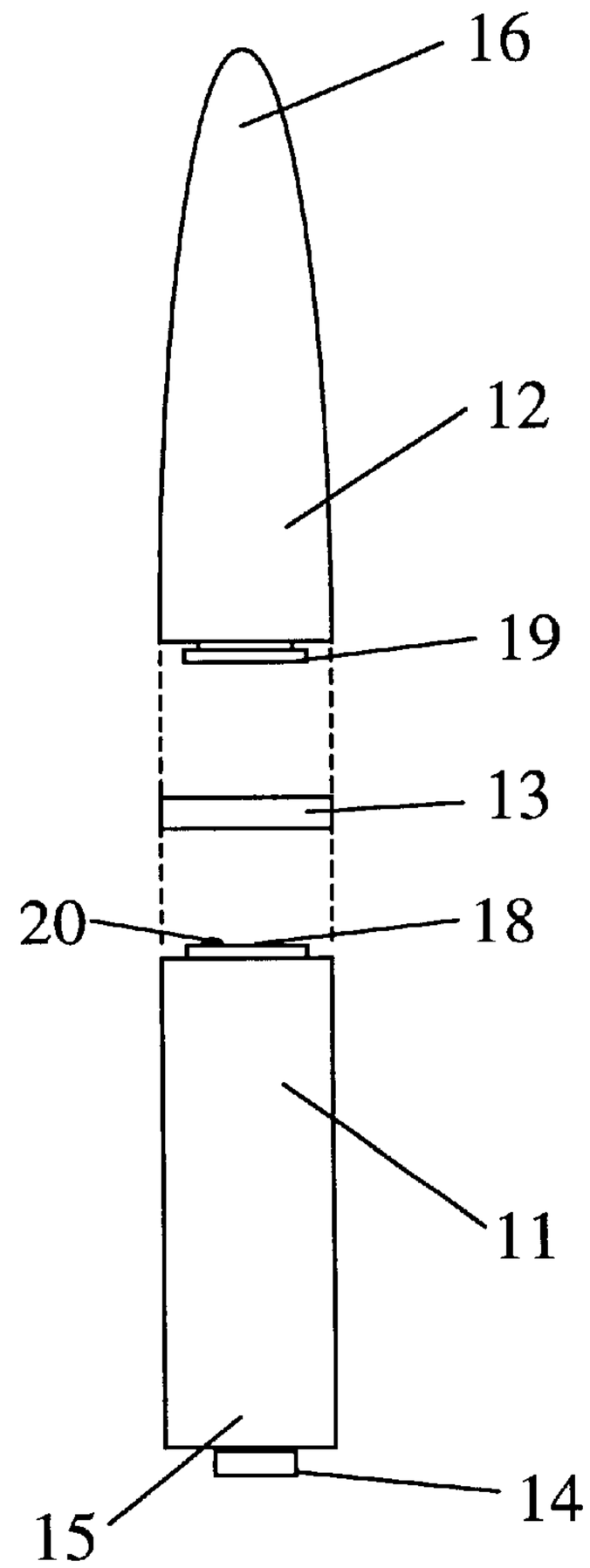


Fig. 2



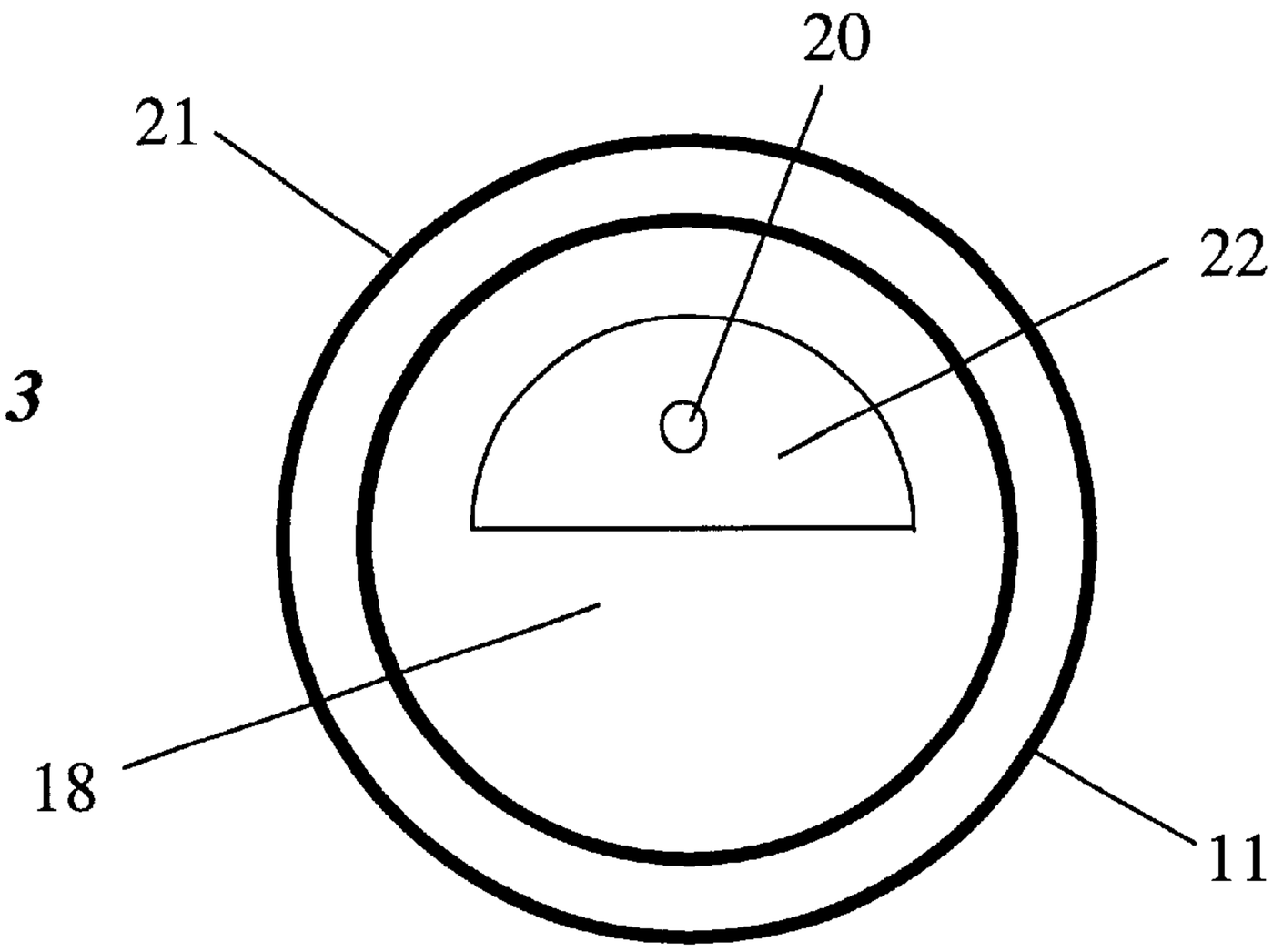


Fig. 3

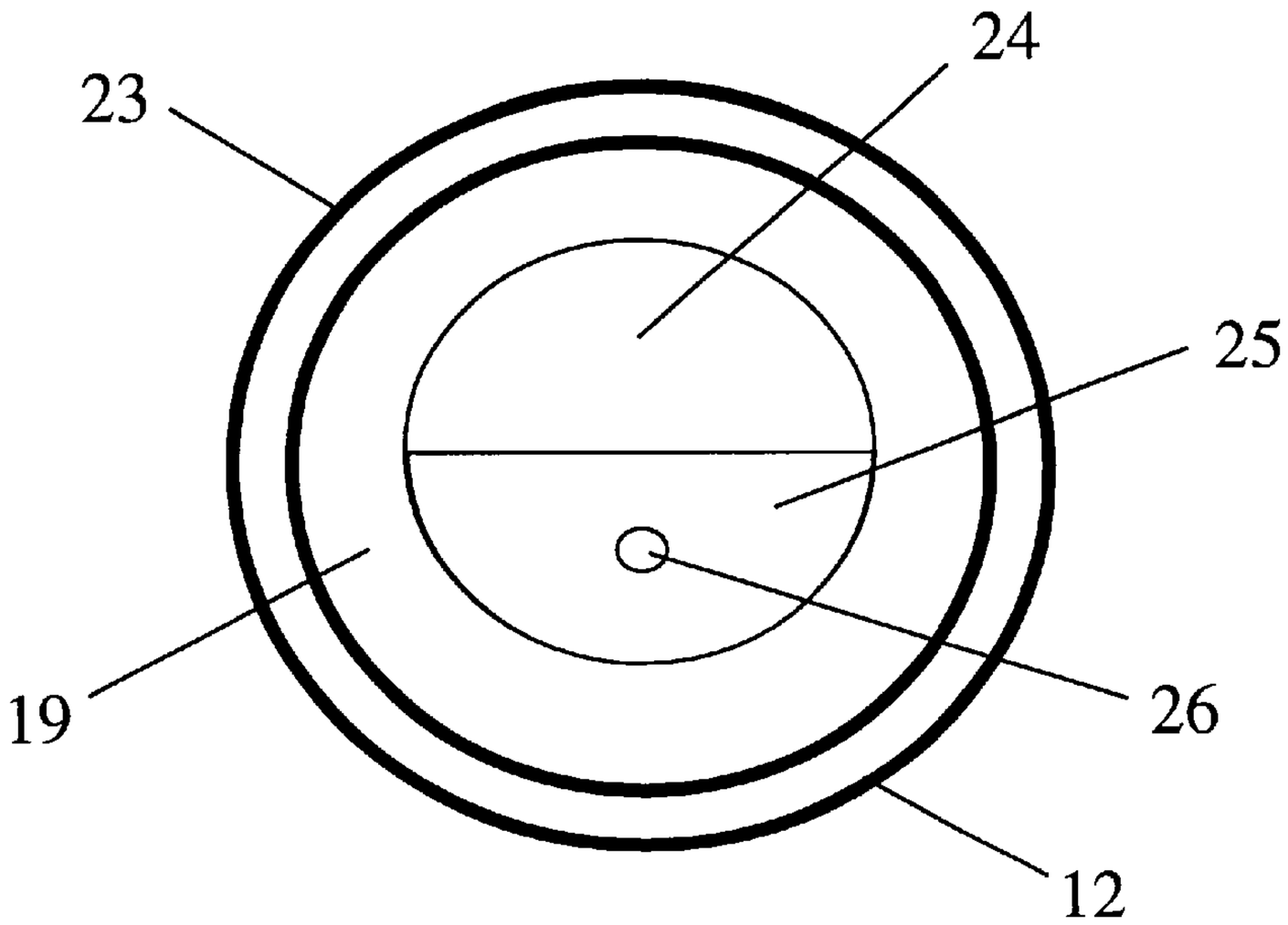


Fig. 4

Fig. 5

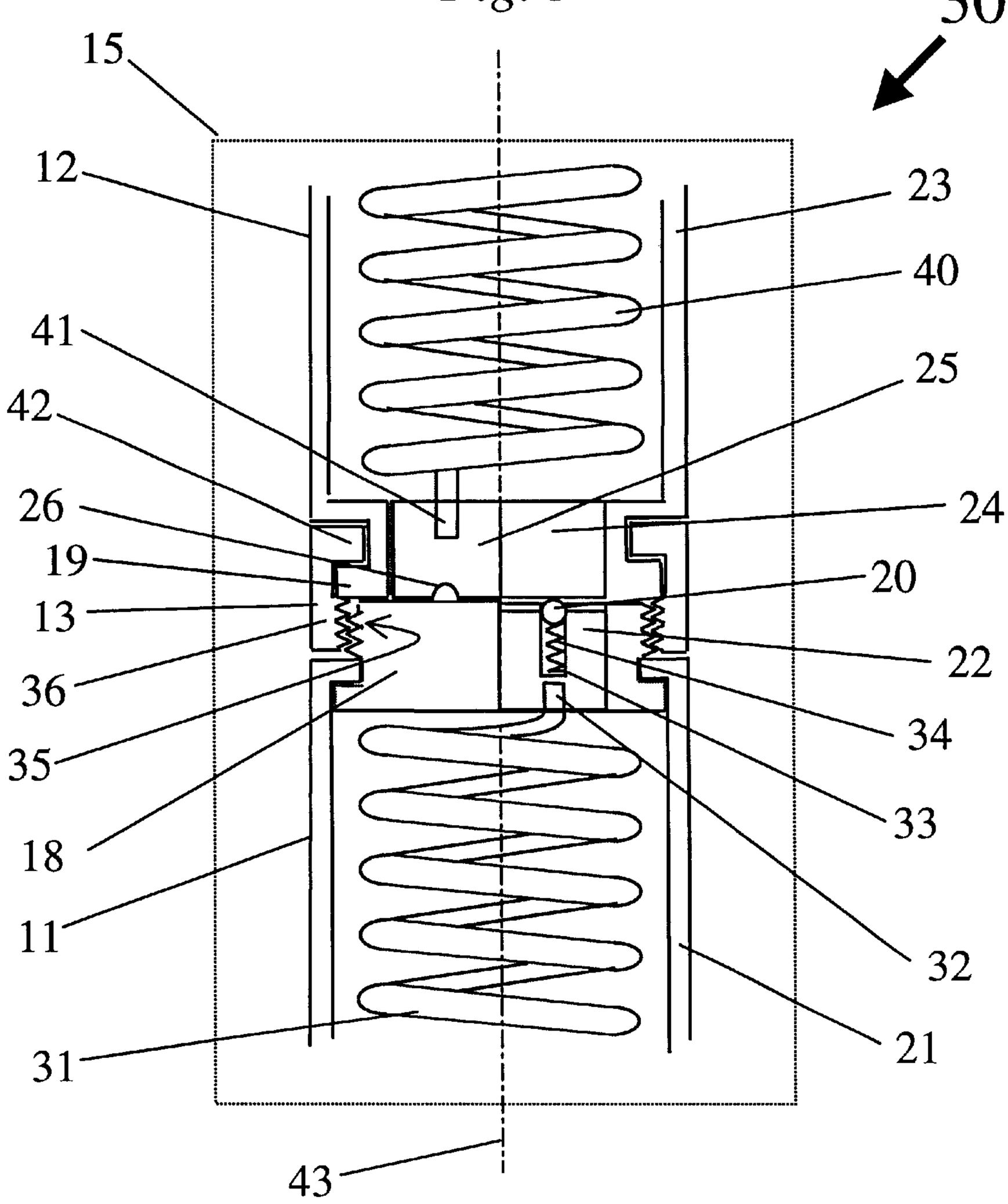
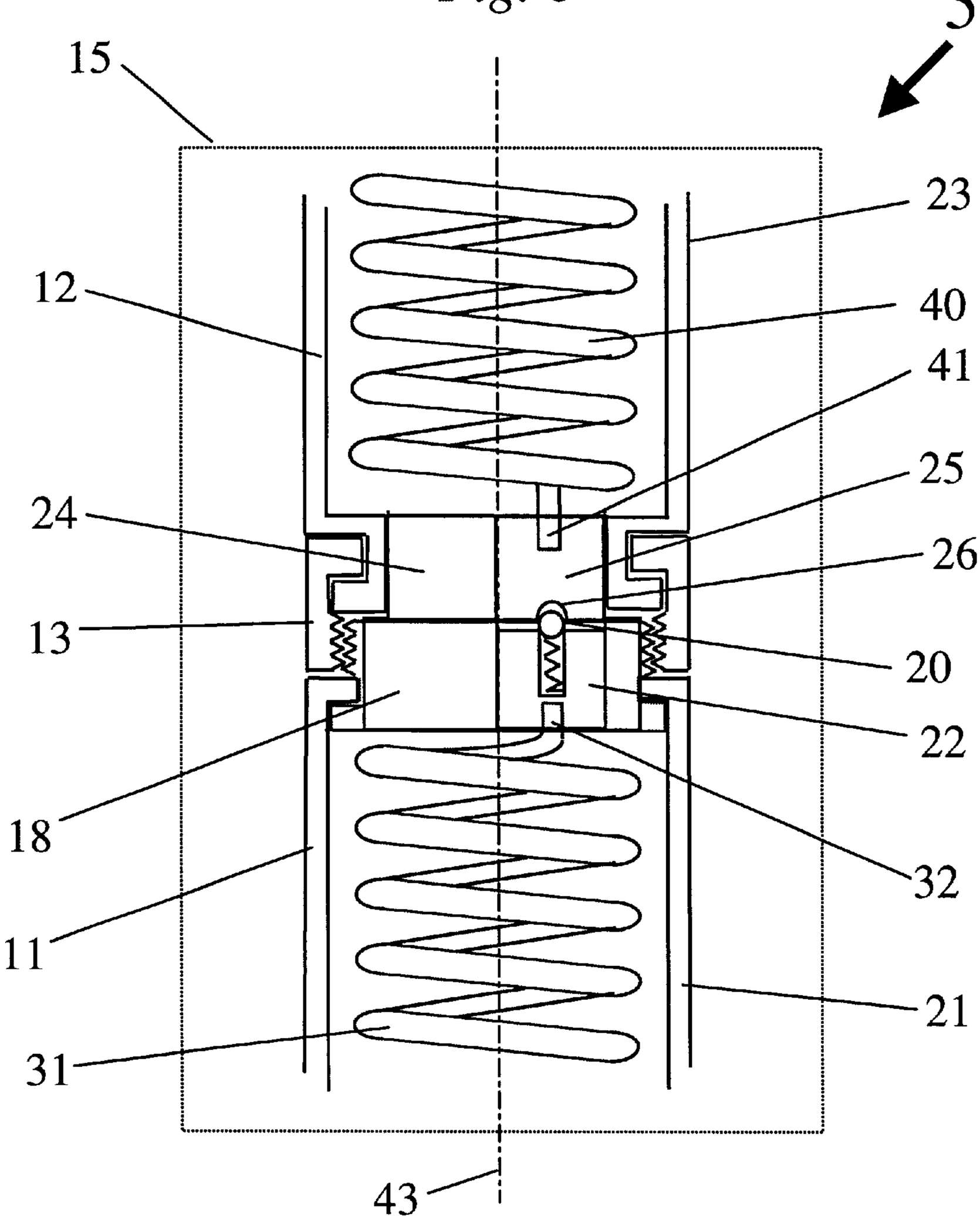


Fig. 6



SWITCHABLE ANTENNA FOR RADIO COMMUNICATION DEVICES

FIELD OF THE INVENTION

This invention relates to antennas for radio communication devices. in particular, this invention relates to, but is not necessarily limited to, a switchable antenna for a radio communication device.

BACKGROUND OF THE INVENTION

Antennas for radio communication devices, such as two-way radios, are known in the art to transceive electromagnetic waves that propagate through space. The type of electromagnetic waves transceived by these two-way radios is radiofrequency (RF) waves that serve as carriers of information. When encoded with information, such carriers are commonly referred to as RF signals.

Conventionally, circuitry of a two-way radio is designed to process RF signals transceived on one or more frequencies within a band of the RF spectrum. For example, the very high frequency (VHF) band for radio communications ranges from 30 MHz to 300 MHz. Accordingly, two-way radios in a VHF radio communication system transceive RF signals using the one or more frequencies within the VHF band.

As is known in the art, the circuitry described in the above needs to couple to an antenna to transceive RF signals. The length of such an antenna depends on wavelength of the RF signals and this wavelength is related to the frequency of the RF signals. Generally, a lower frequency RF signal requires an antenna that is longer than an antenna for a higher frequency RF signal. Hence, there is a problem when a two-way radio has to transceive RF signals varying within a bandwidth that is too wide for an antenna with a fixed length. U.S. Pat. No. 4,772,895 describes an antenna having two helical elements operably coupled to increase the antenna's bandwidth and thereby alleviate this problem. However, such an antenna also has a fixed length that cannot be easily modified to transceive RF signals not within its bandwidth. Therefore, there is a need for an antenna that can transceive RF signals varying within a bandwidth and also be easily modified for RF signals not within this bandwidth.

SUMMARY OF THE INVENTION

According to one aspect of the invention, there is provided a switchable antenna for a radio communication device comprising:

a base antenna assembly comprising a housing with a base antenna;

a secondary antenna assembly comprising a housing with a secondary antenna, said secondary antenna assembly being mounted to said base antenna assembly; and

a switch for selectively electrically coupling adjacent ends of said base antenna and said secondary antenna.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to describe the invention and to put it into practical effect, reference will now be made to a preferred embodiment of the invention as illustrated with reference to the accompanying drawings in which:

FIG. **1** is a side view of a switchable antenna in accordance with a preferred embodiment of the invention;

FIG. **2** is an exploded side view of the switchable antenna of FIG. **1**;

FIG. **3** is a top view of a base antenna assembly of the switchable antenna of FIG. **1**;

FIG. **4** is a bottom view of a secondary antenna assembly of the switchable antenna of FIG. **1**;

FIG. **5** is a longitudinal cross-section through line A–'A of the switchable antenna of FIG. **1** illustrating a first mode of operation; and

FIG. **6** is a longitudinal cross-section through line A–'A of the switchable antenna of FIG. **1** illustrating a second mode of operation.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. **1** there is shown a side view of a switchable antenna **10** comprising a base antenna assembly **11**, a secondary antenna assembly **12** removably mounted with a connector **13** to base antenna assembly **11**. Base antenna assembly **11** comprises a mounting member **14** at a base end **15**. Mounting member **14** mounts base antenna assembly **11** to an antenna socket (not shown) of a radio communication device (not shown) such as, for example, a two-way radio to transceive RF signals. Secondary antenna assembly **12** has a free end **16** distal from base end **15**. A portion **17** of antenna **10** is indicated and will be used to describe how base antenna assembly **11** is mounted to electrically couple to secondary antenna assembly **12**.

Antenna **10** further comprises a switch that is shown in an exploded side view of antenna **10** in FIG. **2**. The switch comprises connector **13**, two contact members **18**,**19** and a contact ball bearing **20**. Contact member **18** and ball bearing **20** is disposed at the top of base antenna assembly **11**. Ball bearing **20** partially protrudes above a surface of contact member **18** and is retained by contact member **18** as it has a diameter that is larger than an opening (not shown in FIG. **2**) for it on contact member **18**. The purpose and operation of this switch is described below.

Referring now to FIG. **3** which is a top view of base antenna assembly **11** showing disposition of contact member **18** and ball bearing **20** relative to the circumference of a housing **21** for base antenna assembly **11**. Contact member **18** is circular and made from a non-electrically conductive material such as a hard plastics. Ball bearing **20** is electrically conductive and disposed on a semi-circular electrically conductive plate **22**.

A bottom view of secondary antenna assembly **12** is shown in FIG. **4**. Disposition of contact member **19** is shown relative to the circumference of a housing **23** for secondary antenna assembly **12**. Near the centre of contact member **19** is a semi-circular non-electrically conductive portion **24** and a semi-circular electrically conductive plate **25**. Like contact member **18**, portion **24** is made of a hard plastics. Conductive plate **25** has a dimple **26** to complementarily engage bearing **20**.

Shown in FIG. **5** is a longitudinal cross-section of portion **17** through line A–'A of antenna **10** illustrating a first mode of operation **30**. In this first mode of operation **30**, secondary antenna assembly **12** is mounted to base antenna assembly **11** with connector **13**. Enclosed in housing **21** is a base helical antenna **31** having an end **32** connected to conductive plate **22**. Conductive plate **22** has a well **33** in which a compressed spring **34** is disposed. Spring **34** attaches to and biases ball bearing **20** towards secondary antenna assembly **12**. As seen in this longitudinal cross-section, contact member **18** has a threaded circumference **35** to engage internal screw threads **36** at one end of connector **13**.

Further shown in FIG. **5** is a secondary helical antenna **40** within secondary antenna assembly **12**. Secondary helical

antenna **40** has an end **41** connected to conductive plate **25**. An inwardly extending lip **42**, disposed at an opposite end of connector **13**, engages contact member **19**. With secondary antenna assembly **12** thus mounted to base antenna assembly **12** along a common longitudinal axis **43**, antenna **10** is enabled to transceive RF signals using only base helical antenna **31** in the first mode of operation **30**.

Referring now to FIG. **6** which illustrates the longitudinal cross-section of portion **17** in a second mode of operation **50** of antenna **10**. In this second mode of operation **50**, ball bearing **20** and contact members **18,19** connects respective ends **32,41** of helical antenna **31** and helical antenna **40**. When both antenna assemblies **11,12** are rotated to such respective positions as shown, ball bearing **20** and dimple **26** generates a click, as is known in the art for such engagement, to indicate that antenna **10** is ready for this second mode of operation **50**. With both antenna assemblies **11,12** in these positions, antenna **10** has increased in length as a result of combining the lengths of both base helical antenna **31** and secondary helical antenna **40**. Accordingly, antenna **10** can now transceive different RF signals corresponding to these lengths compared with RF signals corresponding to the length of helical antenna **31** in the first mode of operation **30**.

As shown in FIGS. **5** and **6**, the switch and adjacent ends **32,41** are intermediately disposed between base end **15** and free end **16**. This switch is selectively activated by relative rotation about common longitudinal axis **43** of base antenna assembly **11** and secondary antenna assembly **12**.

Advantageously, antenna **10** of the present invention is provided with the switch for selectively electrically coupling adjacent ends **32,41** of helical antenna **31** and helical antenna **40**. The relative rotation about common longitudinal axis **43** is possible because secondary antenna assembly **12** is rotatably coupled to base antenna assembly **11** with connector **13**. Consequently, this allows antenna **10** to have different lengths corresponding to the wavelengths of different RF signals. Hence, the present invention enables antenna **10** to transceive RF signals varying within a bandwidth for a radio communication device.

A further advantage of the present invention is that secondary antenna assembly **12** is removably mounted to base antenna assembly **11** using connector **13**. Accordingly, antenna **10** can be mounted with other secondary antenna assemblies **12** to transceive RF signals not within the above bandwidth. Consequently, with the present invention, antenna **10** can be easily modified to change in length using different secondary antenna assemblies **12** unlike conventional antennas that are constrained to a fixed length.

Although the invention has been described with reference to the above preferred embodiment, it is to be understood that the invention is not restricted to the embodiment described herein.

What is claimed is:

1. A switchable antenna for a radio communication device comprising:

a base antenna assembly comprising a housing with a base antenna;

secondary antenna assembly comprising a housing with a secondary antenna, said secondary antenna assembly being mounted to said base antenna assembly; and

a switch for selectively electrically coupling adjacent ends of said base antenna and said secondary antenna, wherein said switch comprises at least one contact ball bearing.

2. A switchable antenna for a radio communication device comprising:

a base antenna assembly comprising a housing with a base antenna;

secondary antenna assembly comprising a housing with a secondary antenna, said secondary antenna assembly being mounted to said base antenna assembly; and

a switch for selectively electrically coupling adjacent ends of said base antenna and said secondary antenna, wherein said switch is selectively activated by relative rotation about a common longitudinal axis of said base antenna assembly and said secondary antenna assembly.

3. The switchable antenna as claimed in claim **2** wherein said secondary antenna assembly is removably mounted to said base antenna assembly.

4. A switchable antenna for a radio communication device comprising:

a base antenna assembly comprising a housing with a base antenna;

secondary antenna assembly comprising a housing with a secondary antenna, said secondary antenna assembly being mounted to said base antenna assembly; and

a switch for selectively electrically coupling adjacent ends of said base antenna and said secondary antenna, wherein said secondary antenna assembly is rotatably coupled to said base antenna assembly.

5. The switchable antenna as claimed in claim **4** wherein said base antenna is a helical antenna.

6. The switchable antenna as claimed in claim **4** wherein said secondary antenna is a helical antenna.

7. The switchable antenna as claimed in claim **4** wherein said base antenna assembly comprises a mounting member at a base end.

8. The switchable antenna as claimed in claim **7** wherein said secondary antenna assembly comprises a free end distal from said base end, said switch and said adjacent ends being intermediately disposed between said base end and said free end.

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